REMARKS

Applicants request reconsideration of the present application in view of this response. Claims 1, 2, 31 and 32 have been amended and claim 35 has been added. Claims 1-35 are currently pending in the present application. Claims 1, 31 and 35 are independent claims.

RAPID PROTOTYPING

In an effort to help explain an example rapid prototyping technique, which may be used in connection with example embodiments of the present invention, Applicants have provided various passages from a textbook titled, Rapid Prototyping, by Andreas Gebhart, published in 2003.

In contrast to abrasive (or subtractive) processes in which a form is shaped by removing material, rapid prototyping processes are processes by which 3D models and components are produced additively. See Gebhart, pp. 23, 29.

PRIOR ART REJECTIONS

Rejection under 35 U.S.C. § 102

Claims 1, 3, 7-17, 25, 26, 31, 33, and 34 stand rejected under 35 U.S.C. §102(b) as allegedly being anticipated by Wei et al. (U.S. Patent No. 5,231,655, hereinafter referred to as "Wei"). Applicants traverse this rejection.

On page 2 of the outstanding Office Action, the Examiner submits that Wei discloses a method for producing at least one of an antiscatter grid and collimator using "a rapid prototyping technique", relying on column 5, line 42 through column 6, line 53 of Wei. Moreover, in the "***Response to Arguments***" section on page 7 of the Office Action, the Examiner states:

> There is nothing in the claims that excludes a method that requires removing of material...In the present case, the examiner interprets "rapid prototyping technique" to mean a technique that produces a prototype or a model for the subsequent working antiscatter grids or collimators. Consequently, any method that produces a structure as recited in the claims would qualify as a "rapid prototyping technique." See page 8 of the Office Action (emphasis added).

Applicants disagree, especially in view of claims 1 and 31 as now amended.

As discussed in Applicants previous response, Wei discloses a method for forming a collimator including removing material from each of a plurality of collimator plates using photolithographic techniques (Wei; col. 3, ll. 38-40; column 5, lines 1-3). That is, the technique utilized by Wei is an abrasive or subtractive technique.

By contrast, the claimed invention (e.g., as in claim 1) produces at least one of an antiscatter grid and collimator using an "additive rapid prototyping technique", as set forth in claim 1. As described above, and in the attached Gebhart reference, the abrasive or subtractive technique of Wei is not "an additive rapid prototyping technique", as set forth in claim 1. Accordingly, Applicants submit that claim 1 is in condition for allowance.

For at least reasons somewhat similar to those set forth above with regard to claim 1, Applicants submit that claim 31 is also in condition for allowance. Claims 3, 7-17, 25, 26, 33, and 34 are allowable at least by virtue of their dependency upon claims 1 or 31.

Claim Rejections under 35 U.S.C. §103(a)

Claims 2, 19-24, and 32 stand rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Wei in view of Guru et al. (U.S. Patent No. 6,175,615, hereinafter referred to as "Guru"). Applicants respectfully traverse this rejection.

As discussed above, Applicants respectfully submit that Wei fails to teach or suggest an "additive rapid prototyping technique," as set forth in claim 1 and somewhat similarly in claim 31. On page 3 of the Office Action, the Examiner correctly recognizes that Wei fails to teach using a "stereolithography" as the "additive rapid prototyping technique", as set forth in claim 2. The Examiner relies upon Guru to allegedly teach this feature. Applicants disagree.

Guru is directed to a method of fabricating a collimator, which includes generating a computer-aided drawing (CAD) drawing of a two-dimensional collimator and generating a stereo-lithographic (STL) file or files, which correspond to the CAD drawings. The STL files are then used by machining equipment to machine out material to be removed from a solid slab (workpiece)

of radiation absorbing material to form a plurality of focally aligned channels extending through the workpiece (Guru; col. 3, ll. 1-12).

Although Guru may arguably create a stereo-lithographic file, the collimator is not produced using stereolithography. By contrast, in Guru the collimator is formed by removing material. That is, the SLT file controls the machining equipment, which removes the material (Guru; col. 5, ll. 29-31). Thus, Guru also fails to teach the "additive rapid prototyping technique," of claim 1.

Accordingly, even assuming *arguendo* that Guru could be combined with Wei (which Applicants do not admit), Guru still fails to at least make up for the deficiencies of Wei with respect to claim 1. Thus, claim 2 is in condition for allowance.

For at least reasons somewhat similar, claims 19-24, and 32 are also in condition for allowance.

Claim Rejections under 35 U.S.C. §103(a)

Claims 6 and 18 stand rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Wei in view of Logan (U.S. Patent No. 5,418,833, hereinafter referred to as "Logan"). Applicants traverse this rejection.

As discussed above, Wei fails to teach the "additive rapid prototyping technique," of claim 1. On page 4 of the Office Action, the Examiner correctly acknowledges that Wei fails to teach or suggest a "coating is performed by at least one of sputtering an electrolytic deposition," as set forth in claims 6 and

18. The Examiner relies upon Logan to allegedly teach these features. Applicants disagree.

Logan discloses a method of creating openings, grooves or microchannels in a substrate by removing material (i.e., by etching; Logan; col. 4, ll. 49-52). Thus, Logan also fails to teach the "additive rapid prototyping technique," of claim 1.

Accordingly, even assuming *arguendo* that Logan could be combined with Wei (which Applicants do not admit), Applicants submit that Logan would still fail to at least make up for at least the deficiencies of Wei with regard to claim 1. Thus, claims 6 and 18 are in condition for allowance.

Claim Rejections under 35 U.S.C. §103(a)

Claims 1, 3, 4, 6, 7-18, 25-28, 31, 33, and 34 stand rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Logan in view of Wei. Applicants traverse this rejection.

As discussed above, Logan discloses a method of creating openings, grooves or microchannels in a substrate by removing material (i.e., by etching; Logan; col. 4, ll. 49-52; col. 6, ll. 18). That is, the technique utilized by Logan is an abrasive or subtractive technique somewhat similar to that of Wei.

By contrast, the claimed invention (e.g., as in claim 1) produces at least one of an antiscatter grid and collimator using an "additive rapid prototyping technique", as set forth in claim 1. As described above, and in the attached

Gebhart reference, the abrasive or subtractive technique of Logan is <u>not</u> an "<u>additive</u> rapid prototyping technique," as set forth in claim 1.

Moreover, as discussed above, Wei also fails to teach an <u>additive</u> rapid prototyping technique," as set forth in claim 1. Accordingly, even assuming *arguendo* that Logan could be combined with Wei (which Applicants do not admit), the alleged combination would still fail to teach at least an "<u>additive</u> rapid prototyping technique," as set forth in claim 1. Thus, claim 1 is in condition for allowance.

For at least reasons somewhat similar to those set forth above with regard to claim 1, claim 31 is also in condition for allowance. Claims 3, 4, 6, 7-18, 25-28, 33, and 34 are allowable at least by virtue of their dependency from claims 1 or 31.

<u>Claim Rejections under 35 U.S.C. §103(a)</u>

Claims 2, 19-24, and 32 stand rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Logan in view of Wei and further in view of Guru. Applicants respectfully traverse this rejection.

Neither Logan nor Wei teaches an "additive rapid prototyping technique," of claims 1 or 31.

On page 7 of the Office Action, the Examiner correctly acknowledges that Logan and Wei fail to teach or suggest "stereolithography," as the "additive rapid prototyping technique," as set forth in claim 2. The Examiner relies upon Guru to allegedly teach this feature.

However, as discussed above, Guru also fails to teach the "additive rapid prototyping technique," of claim 1, let alone "stereolithography," used as the "additive rapid prototyping technique," as set forth in claim 2.

Accordingly, even assuming *arguendo* that Guru could be combined with Logan and/or Wei (which Applicants do not admit), Guru still fails to make up for at least the deficiencies of Logan and/or Wei with respect to claim 1. Thus, claim 1 is in condition for allowance.

For at least reasons somewhat similar, claim 31 is in condition for allowance. Claims 19-24, and 32 are also allowable at least by virtue of their dependency upon claim 1 and 31.

NEW CLAIM

Applicants have added new claim 35, which is also believed to be allowable over the prior art of record. Although arguments somewhat similar to those set forth above with regard to claims 1 and/or 31 may apply; claim 35 should be interpreted solely by the limitations presented therein and should not be limited by any other claim. Applicants request allowance of newly added claim 35.

CONCLUSION

In view of above remarks, reconsideration of the outstanding rejection and allowance of the pending claims is respectfully requested.

If the Examiner believes that personal communication will expedite prosecution of this application, the Examiner is invited to telephone Andrew M. Waxman, Reg. No. 56,007, at the number of the undersigned listed below.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 08-0750 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

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Attachment

Rapid Prototyping

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Preface

"From an engineer's toy to the key to fast product development" proclaimed the caption in the Preface of the first German edition of this book.

At the end of 1995, about 6 years after the first stereolithography machines had been installed in Europe, rapid prototyping processes had developed into effective tools enabling product development to accelerate and improve. They had envolved from an occasionally used, technically fascinating but economically unattractive model-making procedure to a speed determining element in the product development chain.

Apart from stereolithography, other prototyping processes were also established. The range of materials that may be used was drastically increased. The physical properties of models could be considerably improved, and their characteristics approached those of the target material. Higher precision and faster machines resulted in better models at lower costs.

"From a tool for fast product development to a tool for fast product formation" best captions the development since 1995. The urgent desire for plastic or metal prototypes with series-identical standards was the driving force for the further development of already existing plastic processing methods, on which processes for metal, sand, ceramics, and other materials are based, and especially for processes that enable the production of molds and tools. These applications of rapid prototyping technology, collectively known as rapid tooling, and all processes that directly or indirectly facilitate the processing of metals therefore became the center of attention. They are of special interest as, being the interface between development and production, they effectively shorten the "step into the tool" which is time-consuming and expensive when traditional methods are used. This book therefore contains detailed sections on rapid tooling.

Processes that complement, limit, or to a certain degree, compete with rapid prototyping are discussed only insofar as necessary to make the rapid prototyping process understandable. This applies especially to methods of virtual reality, high-speed milling, and conventional processes. The same applies to the intensive discussion of CAD processes and reverse engineering. Bibliographical references enable the reader to further deepen his or her knowledge on these subjects.

We should be aware that this edition can present only a snapshot at this moment in time. The rapid prototyping market is still developing at lightning speed. The number of systems sold worldwide doubled between 1995 and 1997 and, after a poor 1998, is growing since at a nearly constant 200 systems per year. There is no visible end to this development, although slightly degressive growth rates seem to indicate that the scene is settling.

Rapid prototyping processes have established themselves as tools providing effective support in product formation processes. Their use therefore does not give a competitive edge. The reverse conclusion also applies: Not to use them means fighting with blunt weapons.

Andreas Gebhardt

pertinent CAx components are shown. It can be clearly seen how the conventional model making interrupts the data flow, denying a closed CIM structure. If rapid prototyping techniques are employed in simultaneous engineering, however, closed data structures become visible that are vertically compatible and that allow all members of the product development team to have access to the current data record at all times. It also becomes clear that, in contrast to classical model making, rapid prototyping processes are not restricted to one (or more) model making phase(s) but that they can be used randomly for various model characteristics at any point in the product generating process.

1.4.2 Definition: Rapid Prototyping – Rapid Tooling – Rapid Manufacturing

All processes by which 3D models and components are produced additively, that is, by fitting or mounting volume elements together (voxels or layers) are called *generative production processes*. This precise generic term is seldom used in practice. More common are various terms that relate to the single aspects of the component. Solid freeform manufacturing (SFM), sometimes called solid freeform fabrication (SFF), emphasizes the ability to produce framed solids by means of free form surfaces; desktop manufacturing (DMF) enables components to be produced in an office environment (on the table). A number of these terms can be found in specialized literature on the subject and mostly appear in the form of three-letter abbreviations and are more often confusing than explanatory (those used most often are explained in the text).

Each term in use has its justification, from the point of view of its author at least, and is a suitable expression for the specific purpose it is used for and cannot be exchanged against any other term. However, in this book the term *rapid prototyping* is used deliberately and constantly as a generic term. The expression "rapid prototyping process" is certainly not the best, maybe even one of the worst terms available to us. Rapid prototyping tells us nothing when closely analyzed. "Rapid" is relative. It gains quality only when it tells us "faster than what" or at least "how fast." There is also a certain danger in using the term "rapid": it could mean that these processes are intrinsically faster than others. This is not necessarily so. There is no general rule to be found here. The speed of rapid prototyping processes depends to a great extent on the geometry. Whoever needs only a board of 25 · 25 · 1 inch is better served by the semifinished product and a saw. No computer-aided model making process will be faster.

The word "prototyping" is also inapt because many applications of computer-aided production processes do not deal with the production of prototypes in the strict sense. Apart from design models and demonstration models, molds and tools are made and even (small) series are produced.

The term *rapid prototyping* has, however, an unbeatable practical advantage. It is engraved in everyone's memory. It is viewed as a synonym for computer-controlled and therefore automatic generative processes. Rapid prototyping together with its most prominent member, stereolithography, are well known in this combination. They are self-explanatory and thereby fulfill the most important requirements of a standard term.

Figure 1-12 summarizes the various applications of rapid prototyping technology with respect to specialization and the similarity to the later mass product of the models thereby produced.

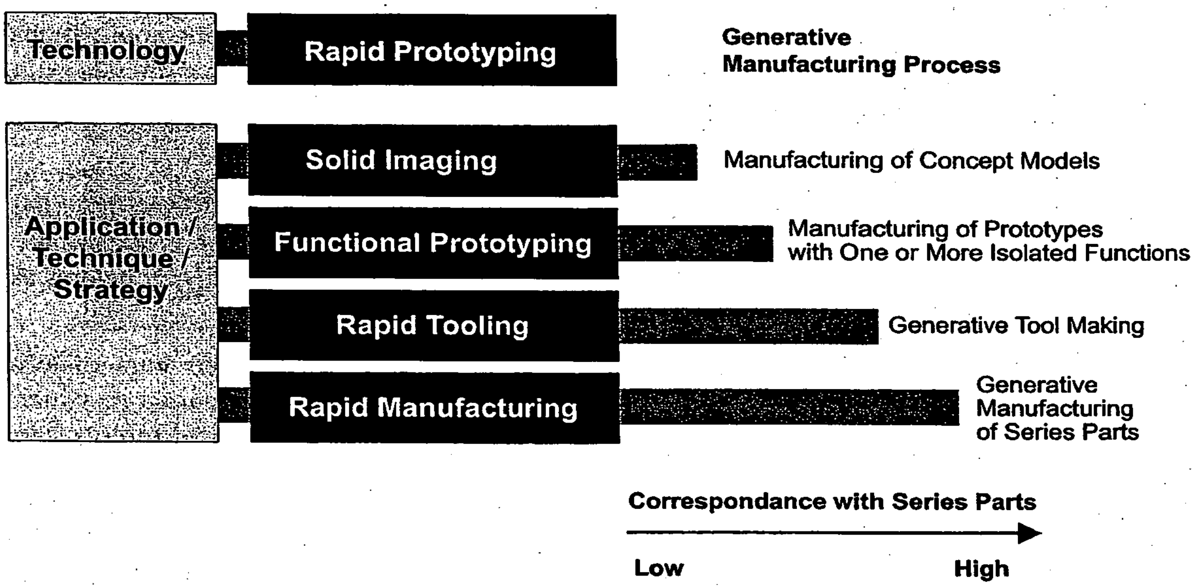

Figure 1-12 Rapid prototyping technology and its applications

If we follow the actual terminology the following definitions result:

- *Rapid prototyping*

  Rapid prototyping describes the technology of generative production processes.

Solid imaging and functional prototyping describe the applications of rapid prototyping technology. Solid imaging includes the production of relatively simple, mechanical-technological nonresilient models that nonetheless display the outer form and the features of the final component relatively well.

Functional prototyping is the application of rapid prototyping technology to prototypes made of plastic, metal, or other materials that simulate one or more mechanical-technological functionalities of the final series component.

In many cases solid imaging and functional prototyping often become the time-determining factor during the first phase of product development.

- *Rapid tooling*

  Rapid tooling describes those applications that are aimed at making tools and molds for the production of prototypes and preseries products by using the same processes as those used in rapid prototyping. This concerns both the model (positive) as well as the mold (negative). Anglophones talk here of "pattern making" and of "mold making."

2 Characteristics of Generative Manufacturing Processes

Industrial rapid prototyping systems on the market today are subject to a high development speed. New processes still in the laboratory stage or under development today will break into the market. At the same time, well tried and tested systems will be upgraded within a relatively short time.

As the equipment presently on the market will be obsolete or approaching obsolence over relatively short periods the physical-technological bases of the various processes are portrayed and discussed in detail in this chapter. Chapter 3 then shows which industrially offered installations derive from which fundamental processes. This procedure not only facilitates the assessment of the current processes, but it also supplies the basis for the assessment of future industrial processes.

This division is also intended to separate the representation of basic principles valid for a longer term from machine concepts that change more quickly. In reality, however, overlaps and repetitions are unavoidable.

2.1 Basic Principles of Rapid Prototyping Processes

Rapid prototyping processes belong to the generative (or additive) production processes. In contrast to abrasive (or subtractive) processes such as lathing, milling, drilling, grinding, eroding, and so forth in which the form is shaped by removing material, in rapid prototyping the component is formed by joining volume elements.

All industrially relevant rapid prototyping processes work in layers. Like the half-breadth-plan of a ship, known from classical model making, single layers are produced and joined to a component.

In the strict sense, rapid prototyping processes are therefore 2½D processes, that is stacked up 2D contours with constant thickness. The layer is shaped (contoured) in an (x-y) plane two-dimensionally. The third dimension results from single layers being stacked up on top